An investigation of the relation between the number of children and education in Italy

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AN INVESTIGATION OF THE RELATION BETWEEN THE NUMBER OF CHILDREN AND EDUCATION IN ITALY [1]

by

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ABSTRACT

In this paper we have investigated the impact of the level of education on the number of children in Italy. We have selected 1,490 families from the 1997- 2005 Longitudinal Investigation on Italian Families (ILFI) dataset. Our dependent variable is represented by the number of children ever born to each respondent (and to his partner). Since the number of children ever born (CEB) is a count variable, we have implemented three empirical models: Poisson, Zero-Truncated Poisson and an Instrumental Variable Poisson, where grandparents' education is exerted as an instrument of parents' education. In particular, we have considered two stages for each model: in the first stage, we have estimated the impact of female's education on her number of children, and in the second one, we have used also partner's education to identify the previous effect. From the empirical results, we may observe a significant negative effect of the level of education on the number of children.

KEYWORDS: Fertility, Human Capital, Education

JEL Classification: I21, J13, J24

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[1] University of Milano Bicocca, University of Trento, University of Bologna. Longitudinal Investigation on Italian families, 1997 – 2005. File on optical support. Scientific responsible: A. Schizzerotto.

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1. INTRODUCTION

Most demographic studies have focused their attention on the role of female's occupation in fertility (Becker, 1993 and Oppenheimer, 1994). These papers have hypothesized that the care for children is assumed a female's responsibility and that rearing and occupation are incompatible. Indeed, higher wages should increase the opportunity costs of childbearing and reduce fertility.

Since female's education is a proxy for her work decision, one could expect a negative relation between women's education and fertility. This theoretical phenomenon represents the basis of the substitution effect.

Nevertheless, other studies have showed a positive impact of female's education on the transition rate to higher order births (Hoem, 1996 and Kravdal, 1992). This fact might be explained by the income effect: higher wages should allow to support larger family (Kravdal, 1992 and Rindfuss et al., 1996). This hypothesis assumes that females can return to work after childbirth and this is possible only in countries where Government incentives make compatible female work and childbearing.

The outline of the paper is as follows: Section 2 discusses the relevant literature. Section 3 describes the data and the estimation procedure. Section 4 discusses the empirical results and Section 5 concludes and gives some suggestions for further research.

2. LITERATURE

The paper deals with the quality-quantity trade-off assumption in the new home economic theory of fertility (Becker, 1981). This theory argues that while an overall increase in household income may be expected to increase the demand for children (i. e. the quantity of children), it may instead lead to an increase in the cost of children (i. e. the quality of children) (Becker and Lewis, 1973; Becker and Tomes, 1976). Thus, parents should choose between a large number of children and a smaller number of children of better 'quality'.

This theory might explain the decrease in fertility in industrialized countries such as Italy. Given that high education is a proxy of the opportunity to find a good occupation and a high income, we may assume a negative association between education and 'quantity' of children.

Numerous empirical studies have attempted to test the quantity-quality trade-off. A priori, the effect of higher education on fertility is ambiguous. In the first step, the particular difficulties of combining education and child-bearing because of the absence of any formal maternity provision for students is likely to result in a delay in family formation. Higher levels are also typically associated with higher wages and so may raise the opportunity cost of taking time out of the labour market for own childcare. Indeed, according to Del Boca, Pasqua and Pronzato (2004), a rise of education induces both income and substitution effects fertility, and the U-shaped pattern of fertility with education can be interpreted in terms of the prevalence of income over substitution effect. But the income effect of education on fertility assumes that child rearing and employment can be made compatible and that, for women, it is possible to return to work after childbirth. According to Del

Boca (2002), this assumption is not plausible in Italy, where public day care is scarce and there are only limited chances to arrange day care by relying on private modes of care. Women with higher levels of education may suffer lower penalties associated with having children (Ratcliffe and Smith, 2006), since employers may have incentives to retain qualified women, in such a way that they can combine paid work and having children.

Happel *et al.* (2004) argue that, in the presence of imperfect capital markets, the desire for smoother consumption may result in a delay in child-bearing if incomes are expected to increase as is typically much more the case for those higher levels of education.

For the UK, Rendall and Smallwood (2003) and Berrington (2004) show for a cohort of women born in the UK between 1954-58 that higher levels of education in the UK are associated with a delay in childbirth and higher levels of childlessness.

3. DATASET DESCRIPTION AND MODELLING

The Longitudinal Investigation on Italian Families (ILFI) dataset[2], used in our empirical analysis, refers to a sample of more than 4,000 Italian families. It has two objectives: the first one is descriptive, to collect basic information about the families (components, source and levels of wages, social and demographic characteristics); the second one analyses social changes to construct the '*life history*' of each member of the family.

In particular, the dataset consists of eight aspects of life of each member of the family: *the geographic mobility,* to learn where the individual was born and lived in the past and where he lives now; *education and professional formation,* to pick up his level of culture and theoretical experience; *labour,* which considers all work positions the individual had in the past; *family,* to identify the role of each family member and past situations, such as marriages; *wages,* which considers the wealth available for the family (even if there are many missing data); *social benefits,* taking into account the Government financial transfers for the family; *welfare,* which measures the degree of subjective satisfaction of the family; and, finally, *religion and politics,* which identify the religious and political ideologies of the members of the families.

The dataset provides the "fertility history" of the respondents. We have excluded cases with missing information on the educational attainment of the woman or that of her partner. The selected sample for the analysis of childbirths considers 1,490 Italian families.

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Table 1. Definition of used variables.

	Dependent variable:
Number of children ever born	*NC*
	Independent variables:
Lower education certificate	*Ed1*
Secondary school certificate	*Ed2*
University degree	*Ed3*
Partner's lower education certificate	*Ped1*
Partner's secondary certificate	*Ped2*
Partner's university degree	*Ped3*
Lower education certificate-lower education certificate couple	*LL*
Lower education certificate-secondary certificate couple	*LS*
Lower education certificate-university degree couple	*LU*
Secondary certificate-lower education certificate couple	*SL*
Secondary certificate-secondary certificate couple	*SS*
Secondary certificate-university degree couple	*SU*
University degree-lower education certificate couple	*UL*
University degree-secondary certificate couple	*US*
University degree-university degree couple	*UU*
Work=1 if woman works	*Work*
Partner work=1 if Partner works	*Pwork*
Catholic=1 if woman is catholic	*Catholic*
Catholic partner=1 if partner is catholic	*PCatholic*
Social Benefits=1 if family got public funds for child care	*SB*
Grandparents=1 if grandparents help in child care activity	*G*
Skilled worker =1 if woman is a skilled worker	
Self-employed =1 if woman is a self-employed	
Unskilled worker =1 if woman is an unskilled worker	
P-skilled worker =1 if partner is a skilled worker	
P-self-employed =1 if partner is a self-employed	
P-unskilled worker =1 if partner is an unskilled worker	
	Instruments for 'Education'
Father's education	*Fed1, fed2, fed3*
Father's education for the partner	*Pfed1, pfed2, pfed3*

All the variables used in the estimated model are collected in the table 1, while table 2 reports the descriptive statistics of our sample.

Table 2. Descriptive statistics

	Mean	SD	Observations
NC	1.72	1.071	1,490
Ed1	0.20	0.400	1,490
Ed2	0.49	0.500	1,490
Ed3	0.31	0.465	1,490
Work	0.65	0.476	1,490
Catholic	0.86	0.350	1,490
Skilled worker	0.32	0.465	1,490
Self-employed	0.12	0.324	1,490
Unskilled worker	0.56	0.496	1,490
Fed1	0.64	0.480	1,490
Fed2	0.31	0.462	1,490
Fed3	0.05	0.224	1,490
Ped1	0.21	0.405	1,490
Ped2	0.47	0.499	1,490
Ped3	0.32	0.467	1,490
PWork	0.65	0.476	1,490
PCatholic	0.86	0.352	1,490
P-Skilled worker	0.27	0.445	1,490
P-Self-employed	0.15	0.355	1,490
P-Unskilled worker	0.58	0.494	1,490
Pfed1	0.66	0.475	1,490
Pfed2	0.30	0.458	1,490
Pfed3	0.04	0.206	1,490
SB	0.01	0.052	1,490
G	0.03	0.160	1,490

LL	0.14	0.346	1,490
LS	0.04	0.207	1,490
LU	0.02	0.126	1,490
SL	0.05	0.216	1,490
SS	0.35	0.477	1,490
SU	0.08	0.280	1,490
UL	0.02	0.136	1,490
US	0.08	0.266	1,490
UU	0.22	0.414	1,490

Our dependent variable is represented by the number of children ever born (*NC*) to each respondent (and to his partner). As can be seen from the table, the mean children ever born for all families is 1.71 with a standard error of 1.071. For our multivariate analysis, we can use the educational levels of the female respondent and that of her partner, and that of the couple as a determinant variable. In particular, we have used the highest educational level received at the time of the interview. According to Hoem et al. (2001), it would have been more useful to use education as a time-variant covariate, but in our case, all respondents have completed their studies before the first child was born. We have made a distinction between respondents with a university degree (*ed3*), a secondary school certificate (*ed2)* and lower education certificate (*ed1*). Moreover, we have computed the different combinations between female educational level and that of her partner to pick out the family educational level. Results show that females and her partners have similar educational levels and most of the people have a secondary school certificate, with a mean of 0.49 for females and 0.47 for her partners. If we consider the family educational level, we may observe a strong *homogamy* effect: As we can easily see in our sample, 70 percent of all women live with a partner with the same educational level (*LL*+*SS*+*UU*).

In terms of independent variables, the probability of working and of being catholic for females is equal to that of her partner, 65% in our sample. Two dummies are used to evaluate whether the public funds (*SB*) and the grandparents' help in child care (*G*) might stimulate the fertility rate. We do not consider *wages* in the empirical analysis, because they refer to the current year and not to the year where each child was born. In order to control for the economic situation of the households, we have taken into account the occupation type of the female and that of her partner. In particular, we have distinguished the occupation into three classes: *skilled worker, self-employed* and *unskilled worker* for the females and *P-skilled worker, P-self-employed* and *P-unskilled worker* for the partners. Finally, in order to control for the geographical variation in fertility tastes and education opportunities in Italy, we have included regional dummies in the estimated models. Since the number of children ever born (CEB) is a count variable, Poisson regression is the statistical procedure to conduct these analysis. The Poisson model is superior to ordinary least squares or other linear models because the distribution of a count variable, such as *NC*, is one that is heavily skewed with a long right tail. The skewed distribution of the *NC* is due to the observed distribution of data with a very low mean, a result which may be attributed to many females desiring few children and few females wanting many children in low fertility countries, such as in Italy. Additionally, there might be a problem of over-dispersion and too many zeroes in the dataset. For this reason, we have dropped the cases with a *NC* value of 0, and we have used the Zero-Truncated Poisson model to compare the results with the Poisson regression results. Finally, 'education' variable is assumed exogenous in the previous models. Then, we have also estimated an Instrumental Variable Poisson model (IVPOIS)[3], a Generalized

[3]Nichols, Austin. 2007. IVPOIS: STATA module for IV/GMM Poisson regression.

Method of Moments (GMM) estimator of Poisson regression which allows endogenous variables to be instrumented by excluded instruments. In this case, grandparents' education is applied as instrument of parents' education.

4. MAIN RESULTS

By implementing a Poisson regression model we can try to estimate the impact of the females' level of education on the number of children ever born. In Table 3, we have estimated three models: Model 1 has taken into account only female's education, in Model 2 also the partner's education level is introduced, Model 3 measures the effects once the family educational levels are considered. From the empirical results indicated in Table 3, we can observe a negative effect. In Model 1, compared to being low educated females, being high educated ones multiplies the expected number of children ever born by a factor of 0.81; that is, it decreases by 19% ($e^{-0.21}$), other aspects being equal. This seems to indicate a substitution effect higher than the income one. Once also partner's educational level is introduced in Model 2, the negative impact of the female's education is slightly mitigated. Indeed, now compared to being low educated females, being high educated ones multiplies the expected number of children ever born by a factor of 0.89; that is, it decreases by only 11% ($e^{-0.12}$), a result similar to high educated partners ($e^{-0.14}$). Model 3 shows the results for household educational levels. Also in this case, compared to being low educated couples (*LL*), being more educated couples (*SS, SU, US* and *UU*) multiplies the expected number of children ever born by a factor of about 0.78; that is, it decreases roughly by 22% ($e^{-0.25}$), holding other variables constant. This negative effect for Italy confirm that found in Aldieri *et al.* (2006). As far as the

http://ideas.repec.org/c/boc/bocode/s456890.html control variables are concerned, working and grandparents' help in child care activity affect negatively the number of children. The results of the Wald χ^2-Tests reject the null hypothesis, by confirming that all models, as a whole, are statistically significant.

Table 3. Poisson model estimates

	Model 1	Model 2	Model 3
Constant	0.91***	0.96***	0.94***
Ed2	-0.21***	-0.14***	
Ed3	-0.21***	-0.12***	
Ped2		-0.13***	
Ped3		-0.14***	
LS			0.06
LU			-0.15
SL			-0.02
SS			-0.25***
SU			-0.24***
UL			0.02
US			-0.26***
UU			-0.23***
Work	-0.15***	-0.14***	-0.14***
Partner Work	-0.16***	-0.15***	-0.15***
Catholic	0.05	0.05	0.05
Catholic Partner	-0.03	-0.03	-0.03
Social benefits	-0.21	-0.24	-0.25
Grandparents	-0.15*	-0.15*	-0.17*
Self-employed	0.04	0.02	0.02
Unskilled worker	-0.01	-0.03	-0.04
P-self-employed		0.02	0.02
P-unskilled worker		0.03	0.03
Prob > χ^2	0.0000	0.0000	0.0000

Notes: ***p<0.01, **0.01<p<0.05, *0.05<p<0.10.
Regional dummies are included in the model. Valle d'Aosta is assumed as the reference region.

In the context of fertility, zero observations might be due either to the choice not to have children (i.e. the expected *NC*s are not always 0) or to impossibility to become a mother (i.e. the expected *NC*s are always 0). In order to handle this situation, we have dropped the cases with a *NC* value of 0, and we have estimated the Zero-Truncated Poisson model. Also in this case, we have considered three models, as in the previous estimation procedure. The Zero-Truncated regression results shown in Table 4 indicate that education levels have similar impacts on people who voluntarily choose not to have children and people who are physically infertile. However, we do find a few distinctions comparing the Poisson and the Zero-Truncated results. First, the magnitude of the results for family educational levels in Model 3 are higher with respect to the Poisson results. Second, having social benefits for child care has a negative impact on the number of children, while grandparents' dummy becomes non-significant. Finally, being self-employed with respect to the skilled workers, may positively affect the expected number of children ever born. Also in this case, the Wald χ^2-tests assure that all models, as a whole, are statistically significant.

Table 4. Zero-Truncated Poisson model estimates.

	Model 1	Model 2	Model 3
Constant	0.48*	0.55*	0.57*
Ed2	-0.25***	-0.13***	
Ed3	-0.20***	-0.11*	
Ped2		-0.19***	
Ped3		-0.15**	
LS			-0.02
LU			-0.34**
SL			-0.05
SS			-0.31***
SU			-0.33***
UL			-0.05
US			-0.42***
UU			-0.20***
Work	-0.12***	-0.11***	-0.11***
Partner Work	-0.14***	-0.13***	-0.14***
Catholic	0.03	0.04	0.04
Catholic Partner	-0.04	-0.06	-0.06
Social benefits	-0.63*	-0.70*	-0.73*
Grandparents	-0.17	-0.16	-0.18
Self-employed	0.13*	0.09*	0.09
Unskilled worker	0.05	0.03	0.02
P-self-employed		0.13*	0.12*
P-unskilled worker		0.02	0.01
Prob > χ^2	0.0000	0.0000	0.0000

Notes: ***p<0.01, **0.01<p<0.05, *0.05<p<0.10.
Regional dummies are included in the model. Valle d'Aosta is assumed as the reference region.

Since 'endogeneity' of education is likely to arise in this model, we have also estimated an Instrumental Variable Poisson (IVPOIS) regression model, where parents' educational levels are instrumented by grandparents' educational levels. In Table 5, we have distinguished only two models: Model 1 shows the results for female's education, while Model 2 considers also the partner's education. In Model 1, compared to low educated females, being high educated females multiplies the expected number of children ever born by a factor of 0.68; that is, it decreases by 32% ($e^{-0.38}$), other aspects being equal, while in Model 2 the results for educational levels are not significant. In both models, working affects negatively the *NC* variable. This result seems to stress the relevant role of labour force participation in the family fertility decisions. The endogeneity test[4] rejects the null hypothesis of exogeneity of education variable.

Table 5. Instrumental Variable Poisson Model estimates.

	Model 1	Model 2
Constant	1.08***	0.76
Ed2	-0.13	-0.84
Ed3	-0.38**	-0.19
Ped2		0.67
Ped3		-0.09
Work	-0.17***	-0.19*
Partner Work	-0.19***	-0.19***
Catholic	0.08	0.07
Catholic Partner	-0.05	0.01
Social benefits	-0.22	-0.11
Grandparents	-0.11	-0.16
Self-employed	-0.01	-0.01
Unskilled worker	-0.08	-0.07
P-self-employed		0.01
P-unskilled worker		0.01
Prob > χ^2	0.0000	0.0000

Notes: ***p<0.01, **0.01<p<0.05, *0.05<p<0.10. Regional dummies are included in the model. Valle d'Aosta are assumed as the reference region. Grandparents' education is assumed as instrument of parents' education.

[4] There is not a test for endogeneity in IVPOIS. An easy way to test by hand is to predict a residual in the first stage (OLS of endogenous variable on the used instruments and controls) and test its significance in the second stage (Poisson of independent variable on the endogenous variable, controls and predicted residual). We have reported the result of the endogeneity test in Table 5.

5. DISCUSSION AND CONCLUDING REMARKS

Our task in this work has been that of analysing the empirical relationship between the level of education and the number of children ever born in Italy.

In so doing, we have used the 1997-2005 Longitudinal Investigation on Italian Families (ILFI) dataset. Since our dependent variable, the number of children ever born, is a count variable, we have estimated three models: Poisson, Zero-Truncated Poisson, and Instrumental Variable Poisson (IVPOIS), where parents' educational levels are instrumented by grandparents' educational levels.

Firstly, we have simply measured the impact of female's education on her number of children. In the Poisson model, compared to being low educated females, being high educated ones multiplies the expected number of children ever born by a factor of 0.81; hence, it decreases by 19% ($e^{-0.21}$), other aspects being equal. Once we have employed also the partner's educational levels, the negative impact is slightly attenuated with respect to that of the previous specification. Additionally, we have showed the results for household educational levels. Also in this case, compared to being low educated couples, being more educated couples multiplies the expected number of children ever born by a factor of about 0.78; that is, it decreases roughly by 22% ($e^{-0.25}$), holding other variables constant.

Secondly, since zero observations in the sample might be due either to the choice not to have children (i.e. the expected *NC*s are not always 0) or to impossibility to become a mother (i.e. the expected *NC*s are always 0), we have dropped the cases with a *NC* value of 0, and we have estimated the Zero-Truncated Poisson model.

The empirical results indicate that education levels have similar impacts on people who voluntarily choose not to have children and people who are physically infertile. Finally, we have estimated an Instrumental Variable Poisson (IVPOIS) to handle education variable as 'endogenous'. In particular, parents' educational levels are instrumented by grandparents' educational levels. The results have found that compared to low educated females, being high educated females multiplies the expected number of children ever born by a factor of 0.68; that is, it decreases by 32% ($e^{-0.38}$), other aspects being equal. The paradoxical negative impact of social benefits or grandparents' dummies variables could demonstrate that both familiar and economic help may not be sufficient to boost the fertility rate. Families might need more nurseries.

Overall, the dominant substitution effect result seems to infer the difficulty for females of combining work time and childcare. This result is confirmed by the negative effect of 'work' variable. Assumed that self-employed and unskilled workers have an economic situation worse than that of skilled workers, the positive impact of the relative dummies on the expected number of children could be again attributed to the prevalence of the substitution effect over the income one.

Further investigation is certainty required for a more comprehensive analysis. In particular, it would be interesting to identify other unobserved heterogeneity components to measure the total impact of education on fertility.

References

Aldieri L., Barone A. and C.P. Vinci (2006) . Human Capital and Fertility Decisions in Italy: A Microeconometric Analysis of ECHP Data. *Brussels Economic Review,* 2006, 49(4);

Becker G. S. (1981). Altruism in the Family and Selfishness in the Market Place. Economica, 48(189), 1-15;

Becker G. S. (1993). A Treatise on the Family. Enlarged edition. Cambridge (Massachusetts). Harvard University Press;

Becker G. S., Lewis H. G. (1973). On the Interaction between the Quantity and Quality of Children. Journal of Political Economy, 81(2), S279-88;

Becker G. S., Tomes N. (1976). Child Endowments and the Quantity and Quality of Children. Journal of Political Economy, 84(4), S143-62;

Berrington A. (2004). Perpetual Postponers? Women's, Men's, couple's Fertility Intentions and Subsequent Fertility Behaviour. *Population Trends,* 117, 9-19;

Del Boca D. (2002). The effect of child care and part time opportunities on participation and fertility decisions in Italy. *Journal of Population Economics,* 15(3), 549-573;

Del Boca D, Pasqua S. And Pronzato C. (2004). Employment and Fertility decisions in Italy, France and UK. CHILD Working Paper n. 8/2004, CHILD – Centre for Household, Income, Labour and Demographic Economics – Italy;

Happel S. K., Hill J. K., Low S. A. (2004). An economic Analysis of the timing of childbirth. *Population studies*, 38(2), 299-311;

Hoem J. (1996). The social meaning of the age at second birth for third-birth fertility: A methodological note on the need to sometimes respecify an intermediate variable. *Yearbook of population Research in Finland* 33: 333-339;

Hoem J., Prskawetz M. and Neyer G. (2001). Autonomy or conservative adjustment? The effect of public policies and educational attainment on third births in Austria. *Population Studies,* 55: 249-261;

Kravdal O. (1992). The emergence of a positive relation between education and third birth rates in Norway with supportive evidence from the United States. *Population Studies,* 46(3), 459-475;

Nichols A. (2007). Causal inference with observational data. *STATA Journal,* 7(4): 507-541;

Oppenheimer V. K. (1994). Women's rising employment and the future of the family in industrial societies. *Population and Development Review*, 20(2), 293-342;

Ratcliffe A., Smith S. (2006). Fertility and women's education in the UK: A cohort analysis. Working paper N. 165, CMPO and Institute for Fiscal Studies;

Rendall M. S. and Smallwood S. (2003). Higher qualifications, first-birth timing, and further childbearing in England and Wales. *Population Trends*, 111: 18 -26;

Rindfuss R. R., Morgan P. S., Offutt K. (1996). Education and the changing age pattern of American fertility: 1963-1989. *Demography*, 33(3), 277-290;

University of Milano Bicocca, University of Trento, University of Bologna. Longitudinal Investigation on Italian families, 1997 – 2005. File on optical support. Scientific responsible: A. Schizzerotto.